CALCULUS.

172. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, O.

Solve $x\dfrac{dy}{dx}=\dfrac{y}{y^{-1}-\log x}$.

Solution by W. W. BEMAN, A. M., Professor of Mathematics at the University of Michigan, Ann Arbor, Mich.

Writing the equation in the form $y\dfrac{dx}{x}+\log x\,dy=\dfrac{dy}{y}$, we get $y\log x=\log cy$, or, $x^y=cy$.

Also solved by G. W. Droke, Fayetteville, Ark.; M. E Graber, A.B., Instructor in Mathematics and Physics, Heidelberg University, Tiffin, O.; O. W. Anthony, DeWitt Clinton High School, New York City; G. W. Greenwood, B. A. (Oxon), Professor of Mathematics and Astronomy, McKendree College, Lebanon, Ill.; G. B. M. Zerr, A. M., Ph. D., Parsons, W. Va.

MECHANICS.

161. Proposed by W. J. GREENSTREET, A. M., Editor of The Mathematical Gazette, Stroud, England.

Four equal uniform smoothly jointed rods length a, and width w, form a a rhombus $ABCD$, A and C being in contact with two vertical walls b feet apart. An elastic string, natural length x, modulus λ, keeps the figure in position. The angle of friction at A and C is $\tan^{-1}p$. When the rhombus is just about to slip, find the angle A, and the angle between AB and the vertical.

Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

Suppose the rhombus to be held in form by two strings AC, BD in a state of tension and that the rhombus is in a plane perpendicular to the walls. Let T, T' be the tensions in BD, AC; then the virtual work $T'.\delta AC+T.\delta BD=0$.

But $AC^2+BD^2=4a^2$, $\therefore$ $AC.\delta AC+BD.\delta BD=0$.

$\therefore$ $T'.BD=T.AC$ or $T'=T.AC/BD$.

Let BD make an angle θ with the vertical. Then $b=AC\cos\theta$ or $AC=b\sec\theta$, $BD=x(1+T/\lambda)=x_1$. Let R, S be the reactions at A, C. Revolving horizontally, $R+S=2T'\cos\theta$. Revolving vertically, $(R+S)p=4w$.

$$\therefore\ T'=\frac{2w}{p\cos\theta}=\frac{Tb\sec\theta}{x_1}\ \text{ or }\ T=\frac{2wx_1}{pb}.$$

$$\therefore\ x_1=x\left(1+\frac{2wx_1}{pb\lambda}\right)\ \text{ or }\ x_1=\frac{pb\lambda x}{pb\lambda-2wx}.$$

$x_1=2a\sin\frac{1}{2}A$ or $A=2\sin^{-1}(x_1/2a)$. AB makes with the vertical an angle $\frac{1}{2}B+\theta=\frac{1}{2}\pi-\frac{1}{2}A+\theta$.

162. Proposed by B. F. FINKEL, A.M., M.Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.

Show that the velocity, v, of a wave along the surface of a liquid whose